Inflation Expectations and Choices of Households*

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Abstract

How do households form inflation expectations? Do their inflation expectations affect their choices? To address the first question, we study longitudinal data on household inflation expectations for the period 1993-2016. We find that households have fairly stable inflation expectations at individual-specific levels. Turning to the second question, we link the survey data on inflation expectations to administrative data on assets and liabilities at the household level. We obtain several novel findings. Households with higher inflation expectations have lower net worth (assets minus liabilities). They have both less assets and less liabilities. Moreover, they hold less of all non-liquid assets (savings account, bonds, stocks, mutual funds, and housing).

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1 Introduction

How do individuals form inflation expectations? The answer to this question is of central importance for policy makers. Inflation expectations are viewed as a key determinant of inflation (Bernanke, 2007, Yellen, 2015). Furthermore, in Japan, the United States, and Europe, policies that raise inflation expectations have been proposed as policies to stimulate spending when interest rates are at the effective lower bound. Hence, theoretical and empirical research on expectation formation has been an important input into policy-making.[1]

A question that seems equally important is: Do agents' inflation expectations affect their choices? According to theories that have had a large impact on policy-making in practice, there is a tight link between inflation expectations and choices (e.g., the consumption Euler equation and the New Keynesian Phillips curve in New Keynesian models), but empirically it is still an open question whether there exists such a tight link between inflation expectations and choices, and only if inflation expectations do affect choices, we care about how inflation expectations are formed in the first place.

The key innovation of the paper is that we can link survey data on inflation expectations at the household level and administrative data on income, assets, and liabilities. The survey data on inflation expectations are already interesting, because they are longitudinal data for households. We use the Dutch Household Survey. The survey aims to be representative for the Dutch population. Every year households are asked to forecast prices for the next year. Households participate for several years. Since we can track individual households over time, we can study how individual households update inflation expectations over time. Most papers studying how individuals update inflation expectations over time use either a survey of professional forecasters or the panel component of the Michigan Survey of Consumers, but professional forecasters do not appear prominently in Macroeconomic models and households are surveyed at most twice in the Michigan Survey of Consumers. We therefore begin the paper by investigating how households update inflation expectations over time. We find that a model in which households believe annual inflation follows a first-order autoregressive process and households pay limited attention to current inflation to forecast future inflation matches aggregate updating patterns well. The simplest version of the

[1] For example, the rational expectations revolution has had a large impact on institutional design such as central bank independence and learning models have affected how central banks think about disinflations.

model however cannot match the large cross-sectional heterogeneity in inflation expectations and the high persistence in households' relative views. We therefore generalize the benchmark model by allowing households to believe that official inflation statistics are biased. Heterogeneity in this perceived bias raises both heterogeneity in inflation expectations and persistence in households' relative views.

In the second part, we turn to the key question of the paper: Do agents' inflation expectations affect their choices? We exploit the fact that the same survey (the DNB Household Survey) contains questions on inflation expectations and questions on assets and liabilities. In addition, we exploit the fact that one can match the microdata from the DNB Household Survey with administrative data on income and wealth at the household level. We obtain several novel findings. First, households with higher inflation expectations have lower net worth (assets minus liabilities). Second, households with higher inflation expectations have less assets and less liabilities, for a given net worth. Third, households with higher inflation expectations hold less of all non-liquid assets (savings account, bonds, stocks, mutual funds, and housing). In other words, households with higher inflation expectations accumulate less wealth, are less leveraged, and invest less in non-liquid assets.

There exist only a few papers that study the relationship between inflation expectations and choices by households using microdata. Most papers in this literature examine the relationship between quantitative inflation expectations and answers to qualitative questions on "readiness to spend" (Bachmann et al., 2015, D'Acunto et al., 2016, Andrade et al., 2016, Arioli et al., 2017). These papers use the Michigan Survey of Consumers (MSC) or similar surveys for other countries. Another group of papers exploit recent innovations in the Federal Reserve Bank of New York Survey of Consumer Expectations (SCE): Crump et al. (2015) estimate the elasticity of intertemporal substitution, exploiting the fact that the SCE elicits quantitative measures of both inflation and spending growth expectations; Armantier et al. (2015) find that inflation expectations co-move in a meaningful way with investment choices in a financially incentivized field experiment. Finally, Malmendier and Nagel (2016) investigate the relationship between their model-implied inflation expectations and financial decisions reported in the Survey of Consumer Finances (SCF) at the cohort level. We take a different and complementary approach to the existing papers in this literature. We link microdata on inflation expectations for the period 1993-2016 to administrative data on income, assets, and liabilities at the household level.

The rest of the paper is organized as follows. Section 2 presents the survey data on inflation expectations and the core results on how individual households update inflation expectations over time. Section 3 introduces the administrative data on income, assets, and liabilities, explains the linking of the two data sets, and investigates whether households' inflation expectations affect their choices. Section 4 concludes.

2 Inflation Expectations of Households

In this section, we investigate how households update inflation expectations over time. We present the model, the data, descriptive statistics, and a comparison between a quantitative version of the model and the data.

2.1 Model

In the model, households believe annual inflation follows an AR(1) process, households pay limited attention to current inflation to forecast future inflation, and households may believe that official inflation statistics are biased.

Households' perceived law of motion for inflation is

$$\pi_t = (1-\rho)\, c + \rho \pi_{t-1} + u_t, \tag{1}$$

where π_t is the inflation rate in year t, $\rho \in (-1, 1]$ is the autocorrelation coefficient, $c \in \mathbb{R}$ determines the unconditional expectation of inflation, and $u_t \sim i.i.d.N\left(0, \sigma_u^2\right)$ is the innovation in year t. In every period, household i observes a signal about current inflation which, according to the household, is generated as follows

$$s_{it} = \pi_t + \varepsilon_{it}, \tag{2}$$

where $\varepsilon_{it} \sim i.i.d.N\left(\mu_i, \sigma_\varepsilon^2\right)$ is the noise in the signal, with $\mu_i \in \mathbb{R}$ and $\sigma_\varepsilon^2 \geq 0$. The mean μ_i captures the idea that the household may believe that official inflation statistics are biased. The variance σ_ε^2 captures the idea that the household may be aware of the fact that he or she is paying limited attention to current inflation. The perceived μ_i and the perceived σ_ε^2 affect how the household interprets the signals, s_{it}, that the household receives. We assume that the household uses the steady-state Kalman filter to compute conditional expectations of future inflation.

The aforementioned assumptions imply the following equation for inflation expectations

$$E[\pi_{t+1}|\mathcal{I}_{i,t}] = (1-\rho)\, c - \rho K \mu_i + \rho\,(1-K)\, E[\pi_t|\mathcal{I}_{i,t-1}] + \rho K \pi_t + \rho K \varepsilon_{it}. \tag{3}$$

A household's forecast in year t depends on an individual-specific intercept, the household's forecast in the previous year, the realized inflation rate, and a term that is linear in the noise in the signal. To derive equation (3), note that equation (1) (after deducting c on both sides) is the state equation and equation (2) (after deducting $c + \mu_i$ on both sides) is the observation equation in a state-space representation of the dynamics of the signal. The household first deducts the perceived bias μ_i from the signal to transform the signal into an unbiased signal about current inflation. It follows from the standard equations for the steady-state Kalman filter that the nowcast for inflation is given by

$$E[\pi_t - c|\mathcal{I}_{i,t}] = E[\pi_t - c|\mathcal{I}_{i,t-1}] + K\left(s_{it} - c - \mu_i - E[\pi_t - c|\mathcal{I}_{i,t-1}]\right),$$

or equivalently

$$E[\pi_t|\mathcal{I}_{i,t}] = E[\pi_t|\mathcal{I}_{i,t-1}] + K\left(s_{it} - \mu_i - E[\pi_t|\mathcal{I}_{i,t-1}]\right).$$

The nowcast for inflation is a linear combination of the household's prior mean and the product of the Kalman gain K and the difference between the signal realization and the expected signal realization. The Kalman gain is an increasing function of the perceived signal-to-noise ratio, $\sigma_u^2/\sigma_\varepsilon^2$. Furthermore, the perceived law of motion for inflation implies that the forecast for inflation is a weighted average of the unconditional mean and the nowcast for inflation[2]

$$E[\pi_{t+1}|\mathcal{I}_{i,t}] = (1-\rho)\, c + \rho E[\pi_t|\mathcal{I}_{i,t}].$$

Combining the last two equations yields

$$E[\pi_{t+1}|\mathcal{I}_{i,t}] = (1-\rho)\, c - \rho K \mu_i + \rho\,(1-K)\, E[\pi_t|\mathcal{I}_{i,t-1}] + \rho K s_{it}.$$

Finally, if the signal s_{it} is indeed a linear combination of the current inflation rate and noise, we obtain equation (3) for the inflation forecast of household i in year t.[3]

In sum, the model where households pay limited attention to current inflation to forecast future inflation and believe official inflation statistics may be biased predicts that

$$\pi_{t+1|t,i} = \beta_{0,i} + \beta_1 \pi_{t|t-1,i} + \beta_2 \pi_t + \nu_{it}. \tag{4}$$

[2] If the perceived ρ equals one, the forecast simply equals the nowcast.

[3] The household also believes that equation (3) holds, because the equation only follows from equations (1)-(2) and Bayesian updating, but while the household believes ε_{it} has mean μ_i, the true mean of ε_{it} may differ from μ_i.

Here $\pi_{t+1|t,i} = E[\pi_{t+1}|\mathcal{I}_{i,t}]$ is the forecast of household i in year t, $\pi_{t|t-1,i}$ is the forecast of the same household in year $t-1$, and $\beta_{0,i} = (1-\rho)\,c - \rho K \mu_i$, $\beta_1 = \rho\,(1-K)$, $\beta_2 = \rho K$, and $\nu_{it} = \rho K \varepsilon_{it}$.[4]

Before turning to the survey data on inflation expectations, it is worth pointing out that two other models of forecasts also yield equation (4). First, Patton and Timmermann (2010) propose and estimate a model in which professional forecasters shrink the data-based forecast towards some other individual-specific view. According to their model, the forecast of agent i in year t is a weighted average of the conditional expectation, $E[\pi_{t+1}|\mathcal{I}_{i,t}]$, and some other individual-specific view, ξ_i,

$$\pi_{t+1|t,i} = \omega \xi_i + (1-\omega)\,E[\pi_{t+1}|\mathcal{I}_{i,t}].$$

If the conditional expectation is given by equation (3), then the forecast is given by equation (4) with $\beta_{0,i} = \omega\,[1-\rho\,(1-K)]\,\xi_i + (1-\omega)\,[(1-\rho)\,c - \rho K \mu_i]$, $\beta_1 = \rho\,(1-K)$, $\beta_2 = (1-\omega)\,\rho K$, and $\nu_{it} = (1-\omega)\,\rho K \varepsilon_{it}$.

Second, suppose that households misunderstand the survey question on inflation expectations and submit forecasts for inflation rates at the household level.[5] If households' perceived law of motion for aggregate inflation is given by equation (1), their perceived law of motion for household inflation is aggregate inflation plus a constant, $\pi_{it} = \pi_t + \delta_i$, and households pay limited attention to current household inflation to forecast future household inflation, $s_{it} = \pi_{it} + \varepsilon_{it}$, then the conditional expectation of future household inflation is given by

$$E\,[\pi_{i,t+1}|\mathcal{I}_{i,t}] = (1-\rho)\,(c+\delta_i) + \rho\,(1-K)\,E[\pi_{it}|\mathcal{I}_{i,t-1}] + \rho K s_{it}.$$

Furthermore, if the actual law of motion for household inflation has the form $\pi_{it} = \pi_t + \zeta_{it}$, where ζ_{it} may or may not coincide with δ_i, then the forecast of household i in year t is given by equation (4) with $\beta_{0,i} = (1-\rho)\,(c+\delta_i)$, $\beta_1 = \rho\,(1-K)$, $\beta_2 = \rho K$, and $\nu_{it} = \rho K\,(\zeta_{it} + \varepsilon_{it})$.

Equation (4) for individual forecasts also yields predictions for the cross-sectional average of forecasts and the persistence of relative views. Suppose that there are N households in the population. Summing across i on both sides of equation (4) and dividing by N yields

$$\bar{\pi}_{t+1|t} = \bar{\beta}_0 + \beta_1 \bar{\pi}_{t|t-1} + \beta_2 \pi_t + \bar{\nu}_t. \tag{5}$$

[4] The model also predicts that $\beta_1 + \beta_2 = \rho$ and $\beta_2/\beta_1 = K/(1-K) > 0$.

[5] Kaplan and Schulhofer-Wohl (2016) use scanner data to estimate inflation rates at the household level.

The average forecast in year t depends on the average intercept, the average forecast in year $t-1$, the realized inflation rate in year t, and the average noise in the signal in year t. Deducting the last equation from the previous equation yields

$$\left(\pi_{t+1|t,i} - \bar{\pi}_{t+1|t}\right) = \left(\beta_{0,i} - \bar{\beta}_0\right) + \beta_1 \left(\pi_{t|t-1,i} - \bar{\pi}_{t|t-1}\right) + \left(\nu_{it} - \bar{\nu}_t\right). \tag{6}$$

The relative view of household i in year t depends on the relative intercept, the relative view of the household in the previous year, and the relative noise in the household's signal in year t. Note that heterogeneity in views has two sources: the individual-specific intercept, which has a permanent effect on relative views, and the individual-specific noise, which has a temporary effect on relative views (with persistence that depends on the parameter β_1).

2.2 Data

The inflation expectations microdata is from the DNB Household Survey, conducted annually since 1993 and administered by CentERdata at Tilburg University. The survey aims to be representative for the Dutch population. Households participate for several years. Since one can track individual households over time, one can study how individual households update inflation expectations over time.

The purpose of the DNB Household Survey is to study the economic and psychological determinants of the saving behavior of households. The data are collected through the Internetpanel of CentERdata. Households without a computer and/or access to the Internet are provided a basic computer and an Internet connection.

The DNB Household Survey consists of six questionnaires. The questionnaire "Health and Income" includes several questions about inflation expectations. The data of the DNB Household Survey also contain very detailed information on assets, liabilities, and mortgages. We return to this point in Section 3, where we study administrative and survey data on income, assets, and liabilities.

Beginning with the 2008 wave, the main quantitative question on inflation expectations is:

> "What is the most likely (consumer) prices increase over the next twelve months, do you think?"

Possible answers are:

1%, 2%, 3%, ..., 10%

Respondents are then asked four questions regarding their subjective CDF:

"Of course it is difficult to predict on forehand how much (consumer) prices will increase. Therefore we would like to ask you how sure you are about your prediction."[6]

"How likely do you think that it is that the increase (in percent) in prices in the next twelve months will be less than [Y1]%?"

"How likely do you think that it is that the increase (in percent) in prices in the next twelve months will be less than [Y2]%?"

"How likely do you think that it is that the increase (in percent) in prices in the next twelve months will be more than [Y3]%?"

"How likely do you think that it is that the increase (in percent) in prices in the next twelve months will be more than [Y4]%?"

In the years 1993-2002, households were only asked for a point prediction. The questions read:

"Do you expect prices in general to rise, to remain the same, or to go down, in the next 12 months?"

"If the answer is rise: By what percentage do you expect prices in general to rise in the next 12 months?"

In the intermediate years 2003-2007, households were only asked for their subjective CDF:

"We now would like to learn what you expect will happen to the prices in the next twelve months. What will be the minimum percentage prices could increase over the next twelve months, do you think? If you think prices will decrease, you can fill in a negative percentage by using a minus in front of the number."

"What is the maximum percentage prices will increase over the next twelve months, do you think?"

[6] The values of Y1, Y2, Y3, and Y4 in the following four questions depend on the answers given to the first question.

Calling the answers MIN and MAX, the respondents were asked 4 questions, with $i \in \{2, 4, 6, 8\}$:

> "How likely do you think that it is that the increase in prices in the next twelve months will be less than $\frac{i(MAX-MIN)+MIN}{10}$?"

For the intermediate years 2003-2007, where households were only asked for their subjective CDF, we estimate the mean of the subjective CDF using a piece-wise linear interpolation over the probability density function.

2.3 Results

We now present descriptive statistics for the survey data on inflation expectations and compare a quantitative version of the model presented in Section 2.1 to the data described in Section 2.2.

Figure 1 shows the distribution of point predictions made in the year 2012. Households were asked: "What is the most likely (consumer) prices increase over the next twelve months, do you think?" Possible answers were: 1%, 2%,..., 10%. As one can see, there is large cross-sectional heterogeneity in the answers. Some households answered 1%, while other households picked a number that is one order of magnitude larger, 10%. Close to 1/5 of households chose a number of 5% or larger, even though annual CPI inflation in the Netherlands had been below 4.7% since 1983. However, the large majority of respondents made a very good forecast that year: 2/3 of households answered 2% or 3% in 2012, and CPI inflation turned out to be 2.5% in 2013.

In Figure 2, we illustrate the evolution of the cross-sectional distribution of inflation expectations over time. The cross-sectional distribution of inflation expectations for year t is described by the 10th percentile (dots), the 90th percentile (small dashes), and the mean (large dashes). We also plot the time series for realized CPI inflation (solid line). To facilitate comparison between expectations and realization, the four numbers reported for year t refer to the distribution of forecasts made in year t-1 for year t and the realization in year t. The vertical lines mark changes in the survey questions. Clearly, there is cross-sectional heterogeneity in answers in all years. Furthermore, the cross-sectional mean of reported inflation expectations moves to some extent with realized inflation. Turning to the vertical lines, the changes in the survey questions did not coincide with unusual changes in the cross-sectional mean of reported inflation expectations, but they do seem to coincide with small changes in the cross-sectional heterogeneity in reported inflation expectations. Finally,

it is interesting to look at particular episodes. The euro coins and banknotes were introduced on 1st of January 2002. Inflation increased in 2001 but fell in 2002, 2003, and 2004. By contrast, the cross-sectional mean (and the cross-sectional heterogeneity) of reported inflation expectations increased for 2001 *and* 2002. Thereafter, the cross-sectional mean of inflation expectations has been slowly declining. Next, the main policy rate of the European Central Bank has been 25 basis points or less since 13th of November 2013 until now. Over this period, inflation has fallen fairly sharply from 2.5% (2013) to 1% (2014) to 0.6% (2015) to 0.3% (2016), whereas the cross-sectional mean of reported inflation expectations has fallen much more slowly.[7]

The panel component of the survey data allows us to track individual households over time. Hence, we can investigate how individual households *update* their inflation expectations over time. Several thousand households participated in the survey. It is difficult to visualize several thousand paths for the reported inflation expectation. We therefore present transition matrices. In Table 1, we study the answers of all households with at least two consecutive answers. (More precisely, we study the answers of all households with an answer in the year after the first answer.) The entries are conditional probabilities. The first row of Table 1 contains the relative frequency of different answers in year two given that the answer in year one was 1%. The second row contains the relative frequency of different answers in year two given that the answer in year one was 2%, and so on. The five entries in each row sum to one. The diagonal entries in Table 1 are 0.47, 0.42, 0.33, 0.36, and 0.30. Hence, roughly 1/3 of households gave the same answer in year two as in year one (the fraction is somewhat higher for initial low answers and somewhat lower for initial high answers).

In Table 2, we repeat the exercise for all households with at least three consecutive answers. (More precisely, we repeat the exercise for all households with observations in both years after the first observation). The first panel reports the transition probabilities comparing answers in years one and two. The second panel reports the transition probabilities comparing answers in years two and three. The third panel reports the transition probabilities comparing directly answers in years one and three. The two one-year transition matrices reported in Table 2 look similar to the one-year transition matrix reported in Table 1. This is interesting, but the most striking finding is in the last panel of Table 1. The (1,1) entry of the third panel of Table 2 ("1 to 3") is much larger

[7] For policy implications of a New Keynesian model with a zero lower bound and dispersed information generating sticky and heterogeneous inflation expectations, see Wiederholt (2015).

than the product of row one of panel one and column one of panel two. This means the answers do not follow a Markov process with common transition probabilities. In particular, a household has a higher probability of going from an answer of 2% in year two to an answer of 1% in year three if the household already answered 1% in year one. The same observation applies to the other diagonal entries of the third panel of Table 2. Households seem to have individual-specific attractors for the reported inflation expectation to which they return.

Table 3 confirms this finding. In Table 3, we repeat the exercise for all households with at least four consecutive answers. (More precisely, we repeat the exercise for all households with three observations in the three years after the first observation). The different panels in the table are the three one-year transition matrices and the transition matrix comparing directly the answers in years one and four. Again the diagonal entries of the last transition matrix ("1 to 4") are much larger than the probabilities implied by a Markov process with common transition probabilities and the one-year transition matrices reported in the first three panels. Households tend to return to individual-specific attractors after they have moved away. To identify this feature of the data, one needs more than two observations per household.

In sum, there is large cross-sectional heterogeneity in reported inflation expectations, the cross-sectional mean of reported inflation expectations moves to some extent with realized inflation, and reported inflation expectations seem to have individual-specific attractors.

The model presented in Section 2.1 can match all three features of the data. We now perform a comparison of a quantitative version of the model and the data. To be as transparent as possible, we proceed in three steps. First, we estimate equation (5) with the time series for the cross-sectional mean of inflation expectations and the time series for inflation.[8] This yields estimates of $\bar{\beta}_0$, β_1, β_2, and $\bar{\nu}_t$. Recall that $\bar{\beta}_0$ and $\bar{\nu}_t$ are the cross-sectional averages of $\beta_{0,i}$ and ν_{it}, respectively. Second, we estimate the actual law of motion for inflation using the same time series for inflation as in step 1. Third, we make an assumption about the shape of the cross-sectional distribution of $\beta_{0,i}$, and we make an assumption about the variance of the idiosyncratic component of ν_{it}: (i) $\beta_{0,i}$ has a log-normal distribution, and (ii) the variance of $\hat{\nu}_{it} \equiv \nu_{it} - \bar{\nu}_t$ equals twice the variance of $\bar{\nu}_t$. We choose the parameters of the log-normal distribution to match the cross-sectional variance of

[8] The two time series are plotted in Figure 2.

inflation expectations in 2012.[9] This completes our choice of parameters.

With these parameters, we simulate data for inflation expectations using equation (4) and the actual law of motion for inflation, and we compute transition matrices for reported inflation expectations from the simulated data.[10]

Table 4 shows the results for estimation of equation (5) with the time series for the cross-sectional mean of inflation expectations and the time series for inflation.[11] The estimates of β_1 and β_2 approximately sum to one. According to the model presented in Section 2.1, $\beta_1 + \beta_2 = \rho$ and thus $\beta_1 + \beta_2 = 1$ means households' perceived law of motion for inflation is a random walk. Dividing the estimate of β_1 by the estimate of β_2 yields a value around 1.5. According to the model presented in Section 2.1, $\beta_1/\beta_2 = (1-K)/K$ and thus $\beta_1/\beta_2 = 1.5$ means the Kalman gain is 0.4.

Table 5 shows the results for estimation of an AR(1) for inflation using data for the period 1984-2016.[12] The point estimate of the coefficient on lagged inflation is 0.59 and the point estimate of the constant is 0.72. The estimated variance of the innovation equals 0.76.

Hence, according to the model and these estimates, households believe inflation is more persistent than it actually is (the perceived autocorrelation coefficient for inflation is close to 1 not 0.6) and households pay limited attention to current inflation to forecast future inflation (the estimated Kalman gain is 0.4 not 1).

Next, we turn to the cross-sectional distribution of inflation expectations by households. We set the parameters of the log-normal distribution for $\beta_{0,i}$ to obtain a cross-sectional mean of $\beta_{0,i}$ of 0.40 and a cross-sectional variance of $\beta_{0,i}$ of 0.33. For these values, the cross-sectional mean of $\beta_{0,i}$ equals the estimated value reported in the first column of Table 4, and the cross-sectional standard deviation of inflation expectations equals (on average across time and simulations) the value reported in Figure 1. This completes our choice of parameters. With these model parameters, we simulate time series for individual inflation expectations.

[9] This variance is reported in Figure 1.

[10] We assume that agents with inflation expectations below 1.5% say 1%, agents with inflation expectations in the interval $[1.5\%, 2.5\%)$ say 2%, and so on.

[11] The first column uses inflation expectations as reported by households, where the survey question is asked in three different ways as reported in Section 2.2. The second column adjusts inflation expectations to the same format of the most recent question. Results are similar. In both columns, the inflation data are the official annual inflation data published by Statistics Netherlands.

[12] The inflation data are again the official annual inflation data published by Statistics Netherlands.

Tables 6-8 show the transition matrices computed from the simulated data. The simulated transition matrices are close to the empirical transition matrices (Tables 1-3). There are two features of the data that the model currently misses. First, the diagonal elements in Tables 6-8 for 4-5% and 6% or more are too high. The high diagonal elements for 6% or more are probably due to the fact that the assumption of a log-normal distribution for $\beta_{0,i}$ creates some very high inflation expectations that have a small probability of being revised to much lower values. Second, the (1,1) elements in Tables 6-8 decline somewhat too fast going from Table 6 to Table 7 to Table 8. This is probably due to the assumption that the variance of $\hat{\nu}_{it} \equiv \nu_{it} - \bar{\nu}_t$ equals twice the variance of $\bar{\nu}_t$. A smaller variance of $\hat{\nu}_{it}$ would generate less heterogeneity in inflation expectations from $\hat{\nu}_{it}$ and more heterogeneity in inflation expectations from $\beta_{0,i}$. Recall from equation (6) that these two sources of heterogeneity in individual beliefs (different $\hat{\nu}_{it}$ and $\beta_{0,i}$) have different implications for the dynamics of individual beliefs.

3 Choices of households

In this section, we report novel results on the relationship between inflation expectations and financial decisions of households.

3.1 Data

We exploit the fact that the same survey (the DNB Household Survey) contains questions on inflation expectations and questions on assets and liabilities. The purpose of the DNB Household Survey is to study the economic and psychological determinants of the saving behavior of households. The survey therefore also contains very detailed information on household characteristics. The survey has been conducted annually since 1993 and is administered by CentERdata, a survey research institute at Tilburg University that specializes on Internet surveys. The survey aims to be representative for the Dutch population. Households participate for as long as they want. The survey is refreshed with new households.

Moreover, Statistics Netherlands provides income and wealth measures based on administrative data. Furthermore, Statistics Netherlands provides a working environment, where we could merge the microdata from the DNB Household Survey with the administrative data at the household

level.[13] This allows us, for example, to link the inflation expectation reported by household j in year t to the wealth held in checking and savings accounts by household j in year t, as reported by banks. The following two paragraphs provide more information on the income and wealth measures based on administrative data.

We use disposable household income, which is the sum of labor income, business income, and interest income (including use of the own home), plus transfers and alimony, minus taxes and health insurance premiums. Not measured (or imputed) are income transfers within the family, income transfers abroad, black market income, and alimony to children.

Wealth is measured from several administrative sources, coming from the tax authorities and banks. The Netherlands has a tax on interest income, which is calculated as a fixed rate on the average holdings of cash, checking and savings accounts, stocks and bonds, real estate not being the primary residence, minus debt (including study loans, excluding mortgages for the primary residence). Since there is a threshold of 20,000 euro of wealth for the interest income tax (double the amount for couples), from tax records alone only higher wealth levels would be observed. For households not reporting interest income tax, Statistics Netherlands imputes wealth holdings based on dividend and interest income. Furthermore, banks report wealth held in checking and savings accounts. The value of stocks and bonds is the market value at the beginning of January of a year. Other asset variables include housing value (based for tax purposes, which is correlated with but not necessarily equal to market value), stock ownership in substantial holdings, and business equity. On the liability side the mortgage value of the own home and the sum of other loans (including study loans) are reported.

3.2 Results

We begin by studying the survey data on assets and liabilities. These data are self reported. Table 9 provides summary statistics for the main variables in our analysis. We use data from all survey waves (1993-2016). We have information for 6,921 unique households and the total number of observations per variable is 26,492.

Table 10 studies the relationship between inflation expectations and assets, liabilities, and net worth. In the first column, we regress the value of all assets of the household on the inflation

[13] Statistics Netherlands checks all outputs to guarantee anonymity of households.

expectation of the household.[14] We control for income, education, a number of other household characteristics, and regional characteristics. We also include time fixed effects. In the third column, we regress the value of all liabilities of the household on the inflation expectation of the household. In the fifth column, we regress the net worth of the household on the inflation expectation of the household. In columns two, four, and six, we include a financial literacy index as a control.[15] We obtain three novel findings. Households with higher inflation expectations have less assets, less liabilities, and lower net worth.

In Table 11 we study the relationship between inflation expectations and ownership of assets. In each column, the dependent variable is whether or not the household owns a certain type of asset. The control variables are the same as in Table 10. Households with higher inflation expectations are less likely to own a savings account, mutual funds, bonds, stocks, and a house (with and without controlling for net worth).

Table 12 investigates the relationship between inflation expectations and asset values. In each column, the dependent variable is the total value of a certain type of asset. The control variables are the same as in Table 10. We find that households with higher inflation expectations hold less of all non-liquid assets (with and without controlling for net worth).

In sum, the coefficient on expected inflation is negative in every single regression reported in Tables 10-12. In all regressions, we control for income, education, a number of other household characteristics, and regional characteristics. We also include time fixed effects. We obtain several novel findings: Households with higher inflation expectations have lower net worth; they have less assets and less liabilities; and they hold less of all non-liquid assets (savings account, bonds, stocks, mutual funds, and housing), with and without controlling for net worth. In other words, households with higher inflation expectations have accumulated less wealth, they hold smaller gross positions (i.e., they are less leveraged), and they avoid non-liquid assets.

Next, we turn to the administrative data. As pointed out before, Statistics Netherlands provides income and wealth measures based on administrative data and Statistics Netherlands provides a

[14] Whenever possible we use the inflation expectation of the household head. In the case of a missing value, we use the inflation expectation of the spouse. The variables "female", "retired", "college education", and "age" all refer to the household head. "Children in the house" is a dummy variable.

[15] Financial literacy is measured in 2005. We use the basic financial literacy index described in van Rooij, Lusardi, and Alessie (2011).

working environment, where one can merge the microdata from surveys with the administrative data at the household level. We merged the microdata from the DNB Household Survey (DHS) with the administrative data. We also merged the microdata from another survey, the Consumer Confidence Survey (CCO), with the administrative data.[16] Households were asked in 2011 to 2014 whether they agreed to be matched. 88% of the households appearing in our DHS sample agreed to be matched. For those households, we looked at all observations going back to the year 2008.[17] The resulting sample contains 7,969 observations per variable for 2,134 unique households. In a second step, we add the CCO sample to the DHS sample. The CCO data are cross-sectional data. The CCO data are available for the years 2012-2014. Pooling the DHS sample and the CCO sample results in 24,534 observations per variable for 18,698 unique households.

The second part of Table 9 provides summary statistics for the administrative data. Comparing the summary statistics for the survey data and the summary statistics for the administrative data suggests that stock ownership is underreported in the survey data (11% in the DHS survey versus 35% in the administrative data) and that liabilities are also underreported in the survey data (58% in the DHS survey versus 67% in the administrative data).

Table 13 studies the relationship between inflation expectations and assets, liabilities, and net worth. It repeats the analysis of Table 10 with the administrative data. The coefficient on inflation expectations is negative and significant in all regressions. Households with higher inflation expectations have less assets, less liabilities, and lower net worth.

Table 14 investigates the relationship between inflation expectations and ownership of assets. It repeats the analysis of Table 11 with the administrative data. The coefficient on inflation expectations is negative and statistically significant for bonds, stocks, and home ownership. Households with higher inflation expectations are less likely to own bonds, stocks, and a house (with and without controlling for net worth). A comment on columns one and five is in order. The administrative

[16] The Consumer Confidence Survey (CCO), which is done partly at the request of the European Commission, provides information about the opinions of consumers concerning general economic developments and the financial situation of their own households. The survey contains quantitative and qualitative questions on inflation expectations. The survey is held monthly by means of computerised phone interviews.

[17] We stop in the year 2008, because the number of households who were asked in 2011-2014 and already participated in the DHS survey in 2007 is small and the inflation expectations questions in the DHS survey changed between 2007 and 2008.

data does not contain separate information for checking accounts and savings accounts. Therefore, the dependent variable in columns one and five is whether the household owns a checking account *or* a savings account. The mean dependent variable in both columns is 99%, and whether a household belongs to the remaining 1% is not linked to inflation expectations.

Finally, in Table 15, we study the relationship between inflation expectations and asset values. The coefficient on inflation expectations is negative and statistically significant in all regressions, with the exception of the bonds regression for the DHS sample.[18]

4 Conclusion

To understand how households form inflation expectations, we study longitudinal data on inflation expectations for the period 1993-2016. We find that there is large cross-sectional heterogeneity in reported inflation expectations, reported inflation expectations move to some extent with realized inflation, and there seem to exist individual-specific attractors for reported inflation expectations. We consider a simple model in which households believe annual inflation follows a first-order autoregressive process, households may pay limited attention to current inflation to forecast future inflation, and households may believe official inflation statistics are biased. The model matches the data well once one allows for three deviations from the theoretical benchmark of full-information, rational expectations: (i) households believe inflation is more persistent than it actually is, (ii) households pay limited attention to current inflation, and (iii) households differ in the degree to which they trust official inflation statistics.

Survey data on household inflation expectations is sometimes criticized by arguing that it is probably unrelated to anything that households actually do. This criticism was feasible, because relatively little was known about the empirical relationship between reported inflation expectations and choices of households. To address this criticism, we study the empirical relationship between reported inflation expectations and a broad range of financial decisions of households. We exploit the fact that the same survey (the DNB Household Survey) contains questions on inflation expectations and questions on assets and liabilities. In addition, we exploit the fact that one can match the microdata from the DNB Household Survey with administrative data on income and wealth

[18] The variable "Savings" in the first and sixth column of Table 15 is the sum of the checking account balance and the savings account balance.

at the household level. We obtain several novel findings. First, households with higher inflation expectations have lower net worth (assets minus liabilities). Second, households with higher inflation expectations have less assets and less liabilities, for a given net worth. Third, households with higher inflation expectations hold less of all non-liquid assets (savings account, bonds, stocks, mutual funds, and housing). In other words, households with higher inflation expectations accumulate less wealth, are less leveraged, and invest less in non-liquid assets. These empirical findings seem relevant for Macroeconomics, Finance, and monetary policy.

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Figure 1: Distribution of Point Predictions in 2012

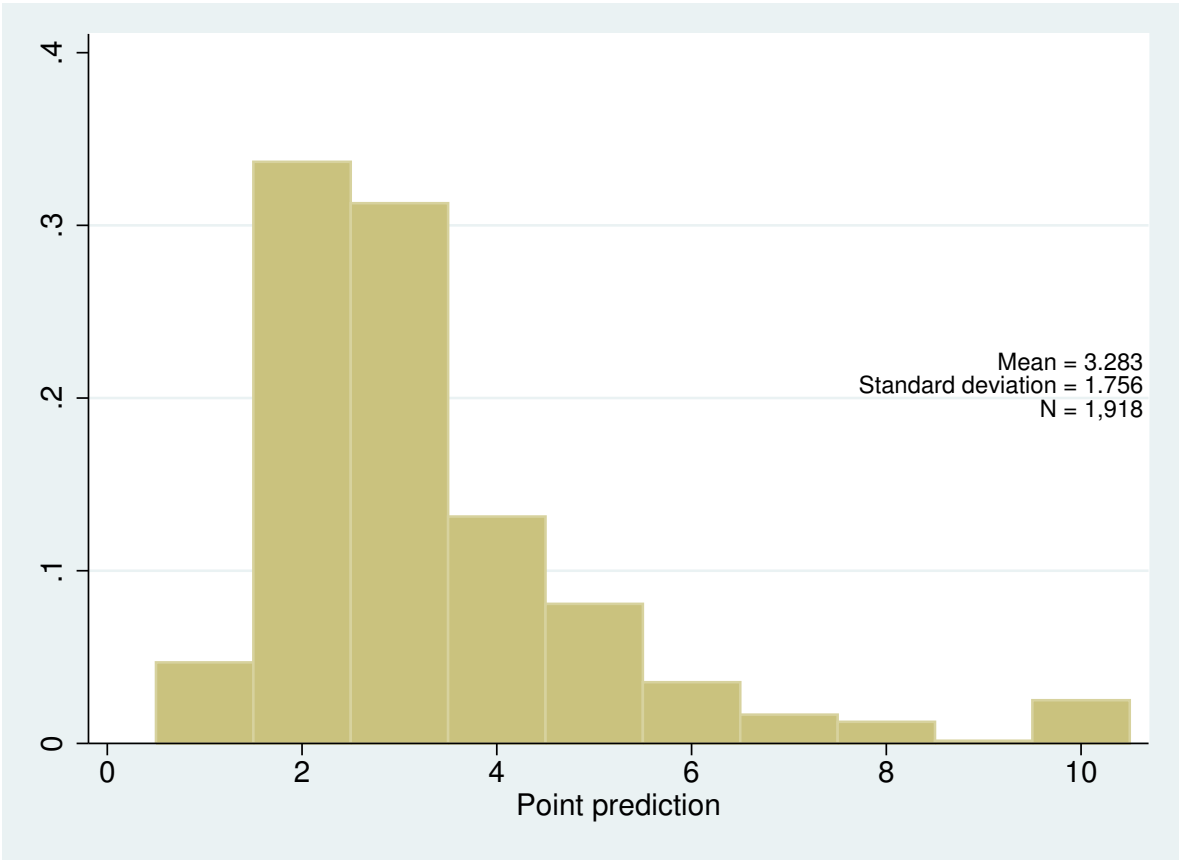

Figure 2: Cross-Sectional Distribution of Inflation Expectations, 1994-2016

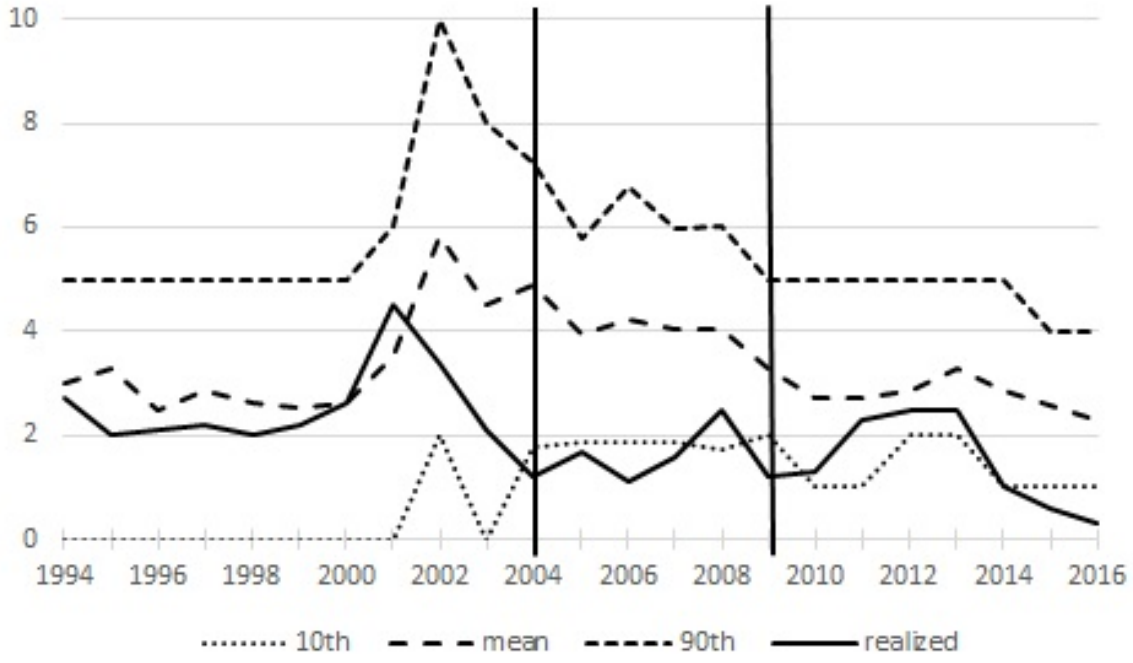

Table 1: Transition matrix, all households with at least 2 adjacent observations

1 to 2

	1% or less	2%	3%	4-5%	6% or more
1% or less	46.7	22.2	15.6	11.3	4.2
2%	20.4	42.0	23.7	10.6	3.3
3%	14.8	27.5	33.1	19.9	4.7
4-5%	13.5	16.7	22.8	35.8	11.2
6% or more	13.2	11.0	14.3	31.9	29.7
N = 8051					

Table 2: Transition matrices, all households with at least 3 adjacent observations

1 to 2

	1% or less	2%	3%	4-5%	6% or more
1% or less	44.3	22.8	17.4	11.4	4.1
2%	18.8	40.0	27.7	10.4	3.6
3%	13.5	26.9	34.3	20.4	4.9
4-5%	12.2	17.6	23.4	35.6	11.2
6% or more	12.2	12.2	12.2	31.7	31.7
N = 4793					

2 to 3

	1% or less	2%	3%	4-5%	6% or more
1% or less	50.9	22.6	10.8	12.3	3.3
2%	24.1	43.3	20.7	9.6	2.3
3%	17.3	31.0	31.9	16.1	3.6
4-5%	13.4	17.4	24.9	34.8	9.5
6% or more	13.0	11.7	16.9	32.5	26.0
N = 4793					

1 to 3

	1% or less	2%	3%	4-5%	6% or more
1% or less	47.2	22.0	15.1	12.4	3.2
2%	24.1	39.4	22.5	12.0	2.0
3%	17.1	32.7	28.2	18.0	4.1
4-5%	17.1	22.0	22.4	29.3	9.3
6% or more	13.3	14.5	18.1	30.1	24.1
N = 4793					

Table 3: Transition matrices, all households with at least 4 adjacent observations

1 to 2

	1% or less	2%	3%	4-5%	6% or more
1% or less	46.3	22.9	19.2	8.9	2.8
2%	17.4	41.7	29.6	8.1	3.2
3%	13.3	28.5	34.4	19.1	4.7
4-5%	11.6	16.6	25.1	36.2	10.6
6% or more	10.6	11.8	14.1	31.8	31.8
N = 3084					

2 to 3

	1% or less	2%	3%	4-5%	6% or more
1% or less	49.5	23.6	10.6	13.5	2.9
2%	22.4	41.0	23.5	10.8	2.2
3%	17.8	29.2	33.3	16.7	3.0
4-5%	12.2	19.1	26.6	33.5	8.5
6% or more	9.6	11.0	20.5	31.5	27.4
N = 3084					

3 to 4

	1% or less	2%	3%	4-5%	6% or more
1% or less	51.3	21.7	15.4	9.6	2.1
2%	21.3	47.2	21.6	8.2	1.8
3%	13.1	30.0	36.3	17.7	3.0
4-5%	14.0	17.2	27.4	32.3	9.1
6% or more	9.1	14.5	18.2	25.5	32.7
N = 3084					

1 to 4

	1% or less	2%	3%	4-5%	6% or more
1% or less	43.7	25.8	14.6	13.1	2.8
2%	24.4	40.7	22.8	10.6	1.6
3%	17.6	32.4	30.9	14.8	4.3
4-5%	17.6	21.1	29.1	24.6	7.5
6% or more	12.0	19.3	22.9	26.5	19.3
N = 3084					

Table 4: Estimation of Equation (5), 1994-2016

	Unadjusted	Adjusted
Expected inflation year t	0.609***	0.570***
	(0.165)	(0.160)
Realized inflation year t	0.440*	0.378**
	(0.212)	(0.160)
Constant	0.398	0.588
	(0.586)	(0.481)
$\hat{\rho}$	1.049***	0.948***
	(0.255)	(0.193)
$\hat{\kappa}$	0.419***	0.398***
	(0.140)	(0.136)
$\hat{\mu}$	−1.122*	−1.289**
	(0.570)	(0.539)
Adjusted R^2	0.619	0.698
Mean expected inflation t+1	3.309	3.157
N observations	23	23

Both columns are estimated with OLS (heteroskedasticity robust standard errors reported in parentheses). The first column uses inflation expectations as reported by households, where the survey question is asked in three different ways as reported in the text. The second column adjusts inflation expectations to the same format of the most recent question. The standard errors of the structural parameters are estimated with the Delta method. Average realized inflation in this period is 1.95%.
*/**/*** correspond to 10%/5%/1%.

Table 5: Estimation of an AR(1) process for inflation, 1984-2016

Inflation year t-1	0.592***
	(0.119)
Constant	0.716***
	(0.266)
N observations	32

The coefficients are estimated with OLS (heteroskedasticity robust standard errors reported in parentheses). */**/*** correspond to 10%/5%/1%.

Table 6: Transition matrix, model, 1 to 2

	1% or less	2%	3%	4-5%	6% or more
1% or less	50.7	30.1	14.9	4.3	0.0
2%	24.9	33.7	27.8	13.4	0.2
3%	10.0	24.8	34.0	29.8	1.3
4-5%	1.9	9.1	23.5	53.7	11.8
6% or more	0.0	0.2	1.9	23.9	73.9

Table 7: Transition matrix, model, 1 to 3

	1% or less	2%	3%	4-5%	6% or more
1% or less	40.9	27.9	19.9	10.9	0.4
2%	26.0	27.9	25.8	19.1	1.3
3%	15.6	23.5	28.1	29.5	3.3
4-5%	5.9	13.4	23.4	43.7	13.5
6% or more	0.3	1.4	4.8	26.5	67.0

Table 8: Transition matrix, model, 1 to 4

	1% or less	2%	3%	4-5%	6% or more
1% or less	35.2	25.9	21.6	16.1	1.2
2%	25.6	24.8	24.4	22.8	2.3
3%	18.0	21.8	25.3	30.0	4.8
4-5%	8.8	14.5	21.8	39.8	15.1
6% or more	1.0	2.8	6.4	25.6	64.3

Table 9: Summary Statistics

A. Survey data	DHS (1993-2015)				
	Nonzero	Mean	St. Dev.	Minimum	Maximum
Expected inflation		3.167	4.244	-15.540	100
Checking account	0.829	1,622	5,437	-263,830	177,376
Savings account	0.755	12,412	37,403	0	2,353,074
Mutual funds	0.176	4,170	22,389	0	868,425
Bonds	0.036	908	10,179	0	501,015
Stocks	0.111	2,902	24,155	0	1,104,528
Financial wealth	0.851	22,015	60,533	-252,091	2,353,821
House value	0.583	94,306	109,136	0	3,417,924
Assets	0.916	137,556	166,049	0	3,721,935
Liabilities	0.584	39,626	72,219	0	3,031,418
Net worth	0.921	97,930	152,987	-2,863,506	3,655,346
NxT observations		26,492			
N unique households		6,921			

Table 9: Summary Statistics (continued)

B. Matched admin data	DHS (2008-2014)			CCO (2012-2014)		
	Nonzero	Mean	St. Dev.	Nonzero	Mean	St. Dev.
Expected inflation					1.899	5.669
Expected inflation (brackets)		2.866	1.526		2.268	2.406
Savings and checking account	0.989	27,778	59,159	0.991	33,396	98,139
Bonds	0.059	1,694	18,542	0.041	2,499	38,277
Stocks	0.349	10,139	43,793	0.250	12,062	85,520
Financial wealth	0.990	39,610	92,477	0.991	47,958	175,360
House value	0.736	116,933	100,735	0.746	115,653	98,446
Assets	0.993	169,872	178,976	0.991	205,398	742,163
Liabilities	0.671	65,008	78,707	0.698	78,093	133,575
Net worth	0.995	104,865	167,794	0.995	127,305	699,151
NxT observations		7,969			16,565	
N unique households		2,134			16,565	

Summary statistics for regression samples Inflation expectations are for the head of the household. All values are real Euro values (1990=100). House value is the taxable value of the house.

Table 10: Inflation Expectations and Assets, Liabilities and Net Worth

	Assets		Liabilities		Net Worth	
Inflation expectations	−1.168***	−1.437***	−0.326***	−0.254*	−0.842***	−1.183***
	(0.219)	(0.439)	(0.073)	(0.131)	(0.193)	(0.393)
Financial literacy (std.)		13.566***		3.572***		9.994***
		(3.157)		(1.113)		(2.899)
Regional unemployment	−8.127***	−11.123**	−1.617*	−2.481	−6.510***	−8.642*
	(2.043)	(5.203)	(0.865)	(1.831)	(1.927)	(4.838)
Couple	35.621***	53.847***	13.784***	12.697**	21.837***	41.151***
	(5.775)	(12.561)	(2.602)	(5.170)	(5.305)	(11.416)
High income panel	79.580***	121.416***	21.168***	16.422	58.412***	104.994***
	(8.081)	(32.833)	(2.707)	(10.578)	(7.510)	(28.991)
Number of household members	9.671***	9.814	2.732**	5.698	6.939**	4.116
	(3.123)	(8.212)	(1.391)	(3.926)	(2.808)	(7.595)
Children in the house	−17.822***	−6.438	−0.300	−4.607	−17.522***	−1.831
	(6.395)	(16.227)	(2.812)	(7.067)	(5.684)	(14.788)
High urbanization	5.810	−4.303	−2.047	−5.643	7.857	1.341
	(6.453)	(14.793)	(2.572)	(4.885)	(5.657)	(12.990)
Moderate urbanization	28.385***	29.891*	1.140	−0.390	27.245***	30.281**
	(7.342)	(16.916)	(2.575)	(5.183)	(6.513)	(15.080)
Low urbanization	35.642***	23.405	1.470	−4.599	34.173***	28.005*
	(7.329)	(16.256)	(2.725)	(5.321)	(6.527)	(14.565)
Very low urbanization	36.026***	15.980	4.756	2.266	31.270***	13.714
	(7.315)	(16.232)	(3.301)	(6.750)	(6.514)	(14.028)
Female	−19.106***	−24.351***	−1.484	−1.741	−17.623***	−22.610***
	(4.653)	(9.352)	(2.563)	(3.372)	(4.252)	(8.002)
Retired	16.675**	37.226**	−2.124	8.320	18.799***	28.906*
	(7.917)	(17.762)	(2.551)	(5.174)	(7.081)	(15.758)
College education	50.665***	40.705***	19.509***	13.079***	31.155***	27.626***
	(4.393)	(9.698)	(1.762)	(3.452)	(4.051)	(8.527)
Age	5.266***	7.589***	0.604	−0.170	4.662***	7.759***
	(0.950)	(1.812)	(0.394)	(0.697)	(0.899)	(1.625)
Age squared	−0.036***	−0.060***	−0.012***	−0.008	−0.025**	−0.051***
	(0.010)	(0.018)	(0.004)	(0.006)	(0.010)	(0.017)
ihs(household income)	3.493***	2.914***	1.285***	1.150***	2.208***	1.764***
	(0.322)	(0.667)	(0.137)	(0.258)	(0.304)	(0.603)
Adjusted R^2	0.189	0.207	0.113	0.141	0.152	0.193
Mean dependent variable	137.556	155.688	39.626	40.576	97.930	115.113
Fraction non-zero	0.916	0.942	0.584	0.603	0.921	0.946
N households	6921	1069	6921	1069	6921	1069
N observations	26492	8465	26492	8465	26492	8465

All columns are estimated with OLS, and standard errors are clustered at the level of the individual. Year fixed effects are included, but not reported. Dependent variables are divided by a 1,000. Income is transformed using the inverse hyperbolic sine transformation in order to incorporate negative and zero values. The baseline for urbanization is "Very high urbanization". Financial literacy is measured in 2005.

*/**/*** correspond to 10%/5%/1%.

Table 11: Inflation Expectations and Ownership of Assets

	Checking	Savings	Funds	Bonds	Stocks	House
Inflation expectations	−0.0006	−0.0013*	−0.0023***	−0.0005*	−0.0013***	−0.0053***
	(0.0007)	(0.0007)	(0.0005)	(0.0002)	(0.0004)	(0.0008)
Regional unemployment	0.0004	−0.0006	−0.0056	−0.0007	−0.0064	0.0081
	(0.0042)	(0.0049)	(0.0053)	(0.0026)	(0.0044)	(0.0064)
Couple	0.0165	0.0117	−0.0017	−0.0024	−0.0199	0.1715***
	(0.0113)	(0.0128)	(0.0142)	(0.0063)	(0.0131)	(0.0191)
High income panel	−0.0123	0.0240*	0.0778***	0.0242**	0.1050***	0.1204***
	(0.0119)	(0.0125)	(0.0198)	(0.0097)	(0.0206)	(0.0144)
Number of household members	−0.0197***	−0.0041	0.0005	0.0058*	0.0088	0.0180**
	(0.0064)	(0.0061)	(0.0064)	(0.0032)	(0.0066)	(0.0079)
Children in the house	−0.0048	−0.0268*	−0.0445***	−0.0164**	−0.0190	0.0190
	(0.0140)	(0.0147)	(0.0152)	(0.0071)	(0.0146)	(0.0192)
High urbanization	−0.0073	−0.0025	0.0055	0.0022	−0.0066	0.1238***
	(0.0118)	(0.0137)	(0.0152)	(0.0069)	(0.0127)	(0.0217)
Moderate urbanization	0.0162	0.0319**	0.0122	−0.0001	−0.0009	0.1975***
	(0.0110)	(0.0133)	(0.0158)	(0.0070)	(0.0139)	(0.0216)
Low urbanization	−0.0077	−0.0066	0.0039	0.0067	0.0060	0.2148***
	(0.0121)	(0.0143)	(0.0160)	(0.0078)	(0.0141)	(0.0225)
Very low urbanization	−0.0161	−0.0053	−0.0154	−0.0000	−0.0038	0.2265***
	(0.0128)	(0.0151)	(0.0163)	(0.0079)	(0.0147)	(0.0224)
Female	0.0136	0.0142	−0.0320***	−0.0054	−0.0372***	−0.0631***
	(0.0095)	(0.0111)	(0.0119)	(0.0048)	(0.0101)	(0.0172)
Retired	0.0524***	0.0564***	0.0344**	0.0009	0.0266*	−0.0207
	(0.0115)	(0.0137)	(0.0168)	(0.0078)	(0.0151)	(0.0198)
College education	0.0128*	0.0084	0.0774***	0.0114**	0.0546***	0.1300***
	(0.0074)	(0.0083)	(0.0103)	(0.0050)	(0.0093)	(0.0124)
Age/10	−0.0008	−0.0247	0.0626***	−0.0177	0.0141	0.1562***
	(0.0164)	(0.0187)	(0.0209)	(0.0116)	(0.0186)	(0.0266)
Age/10 squared	−0.0008	−0.0007	−0.0056***	0.0029**	−0.0005	−0.0148***
	(0.0015)	(0.0018)	(0.0021)	(0.0013)	(0.0019)	(0.0027)
ihs(household income)	0.0163***	0.0196***	0.0066***	0.0011***	0.0028***	0.0014*
	(0.0007)	(0.0008)	(0.0007)	(0.0003)	(0.0006)	(0.0008)
ihs(net worth)	0.0227***	0.0204***	0.0090***	0.0021***	0.0062***	0.0180***
	(0.0008)	(0.0008)	(0.0005)	(0.0002)	(0.0004)	(0.0008)
Adjusted R^2	0.187	0.173	0.076	0.028	0.059	0.259
Mean dependent variable	0.765	0.755	0.176	0.036	0.111	0.712
Without Net Worth						
Inflation expectations	−0.0015**	−0.0021***	−0.0027***	−0.0005**	−0.0016***	−0.0060***
	(0.0007)	(0.0007)	(0.0005)	(0.0002)	(0.0004)	(0.0009)

All columns are estimated with linear probability models (OLS), and standard errors are clustered at the level of the individual. Year fixed effects are included, but not reported. Income and net worth are transformed using the inverse hyperbolic sine transformation in order to incorporate negative and zero values. Each column contains 26,492 observations for 6,921 unique households.
*/**/*** correspond to 10%/5%/1%.

Table 12: Inflation Expectations and Asset Values

	Checking	Savings	Funds	Bonds	Stocks	Financial	Housing
Inflation expectations	−5.3	−71.5*	−77.4***	−16.3**	−86.8***	−257.3***	−439.5***
	(4.5)	(38.8)	(21.8)	(8.1)	(21.9)	(61.0)	(146.5)
Regional unemployment	−88.4*	−36.4	−182.4	−19.9	−488.5	−815.7	−4782.8***
	(45.3)	(448.3)	(303.3)	(129.7)	(329.6)	(820.5)	(1222.4)
Couple	138.1	2949.7**	−1719.2*	−385.1	−2652.1**	−1668.6	21888.3***
	(134.8)	(1147.3)	(1032.4)	(393.0)	(1326.9)	(2861.8)	(3478.7)
High income panel	1186.1***	2720.7*	3476.3**	653.4*	9834.2***	17870.7***	36324.3***
	(208.8)	(1547.9)	(1406.4)	(369.5)	(2556.7)	(4529.4)	(5033.3)
Number of household members	−79.8	172.4	375.0	138.6	825.8	1432.0	6307.1***
	(65.2)	(479.2)	(332.1)	(231.2)	(535.1)	(1168.6)	(1811.9)
Children in the house	−61.7	−3612.0***	−1675.1**	−255.4	−1803.7	−7407.9***	−3390.8
	(159.1)	(1223.6)	(778.4)	(463.4)	(1143.7)	(2585.2)	(3775.3)
High urbanization	−388.5***	−2792.5*	850.5	−238.5	−762.6	−3331.6	4364.9
	(142.1)	(1547.9)	(883.2)	(400.6)	(768.7)	(2313.1)	(4163.4)
Moderate urbanization	−312.3**	−2203.8	1204.1	−208.3	−143.6	−1663.9	16588.9***
	(157.9)	(1651.9)	(1010.2)	(412.5)	(990.1)	(2691.1)	(4478.8)
Low urbanization	−381.2**	−1227.1	1098.3	−77.6	−263.9	−851.5	20888.3***
	(155.5)	(1866.3)	(849.2)	(452.6)	(912.2)	(2787.0)	(4533.4)
Very low urbanization	−217.0	−2375.8	−668.6	−71.7	−431.0	−3764.1	23649.8***
	(172.9)	(1726.7)	(608.9)	(450.9)	(854.8)	(2389.5)	(4936.4)
Female	−264.5***	−806.5	−876.6	−387.8	−1817.9***	−4153.4***	−9725.0***
	(102.0)	(893.2)	(686.2)	(243.2)	(552.7)	(1545.0)	(2984.4)
Retired	215.9	2798.1*	1472.0	−431.9	732.9	4786.9*	6931.8
	(165.7)	(1537.4)	(1183.2)	(384.1)	(948.7)	(2594.5)	(4547.7)
College education	384.6***	3184.8***	3408.7***	77.2	1217.3*	8272.7***	30692.6***
	(95.0)	(847.4)	(682.0)	(250.1)	(637.0)	(1597.3)	(2725.0)
Age	9.3	106.7	−17.7	−84.5	−330.5**	−316.6	1211.7**
	(19.3)	(211.3)	(135.9)	(63.2)	(143.6)	(343.2)	(568.7)
Age squared	0.0	−0.2	1.0	1.3**	4.1***	6.3*	−8.7
	(0.2)	(2.3)	(1.5)	(0.7)	(1.6)	(3.7)	(6.0)
ihs(household income)	32.6***	337.4**	116.1***	35.7**	21.3	543.0***	1439.7***
	(7.3)	(140.5)	(36.4)	(14.7)	(43.5)	(160.7)	(179.4)
ihs(net worth)	94.3***	853.4***	322.4***	72.5***	225.4***	1568.0***	4929.3***
	(4.7)	(57.1)	(30.5)	(12.0)	(26.2)	(84.0)	(174.5)
Adjusted R^2	0.046	0.054	0.033	0.011	0.033	0.079	0.298
Mean dependent variable	1823	12412	4170	908	2902	22216	94306
Fraction non-zero	0.765	0.755	0.176	0.036	0.111	0.837	0.583
Without Net Worth							
Inflation expectations	−9.0**	−105.0***	−90.1***	−19.1**	−95.7***	−318.9***	−633.4***
	(4.6)	(40.6)	(22.3)	(8.3)	(22.6)	(64.5)	(158.4)

All columns are estimated with OLS, and standard errors are clustered at the individual level. Year fixed effects are included, but not reported. Income and net worth are transformed using the inverse hyperbolic sine transformation in order to incorporate negative and zero values. Each column contains 26,492 observations for 6,921 unique households.
*/**/*** correspond to 10%/5%/1%.

Table 13: Inflation Expectations and Assets, Liabilities and Net Worth, Administrative Data

	Pooled DHS and CCO			DHS		
	Assets	Liabilities	Net Worth	Assets	Liabilities	Net Worth
Inflation expectations	−2.721***	−0.888***	−1.833***	−7.167***	−2.444***	−4.723***
	(0.425)	(0.129)	(0.362)	(1.617)	(0.771)	(1.413)
Regional unemployment	−15.340**	−1.405	−13.935**	−0.026	0.032	−0.058
	(7.170)	(1.218)	(6.797)	(8.355)	(2.762)	(7.635)
Couple	48.493***	24.180***	24.314***	45.876***	24.910***	20.966**
	(9.355)	(2.563)	(8.690)	(10.967)	(5.041)	(10.436)
Number of household members	31.949***	9.726***	22.223***	5.124	1.922	3.201
	(8.024)	(1.438)	(7.601)	(6.999)	(3.138)	(7.049)
Children in the house	−42.117***	10.702***	−52.819***	4.262	10.394	−6.132
	(16.185)	(3.213)	(15.302)	(16.001)	(6.438)	(15.706)
High urbanization	−14.078*	0.320	−14.398**	15.824	−0.480	16.303
	(7.837)	(2.796)	(6.966)	(11.355)	(4.912)	(10.043)
Moderate urbanization	14.585	6.223**	8.361	38.046***	6.485	31.561***
	(9.007)	(2.806)	(8.083)	(11.598)	(5.121)	(10.137)
Low urbanization	33.406***	4.175	29.232**	62.058***	9.937*	52.122***
	(12.727)	(2.902)	(11.796)	(14.971)	(5.832)	(13.376)
Very low urbanization	14.485*	−0.538	15.023**	54.702***	14.214**	40.489***
	(8.538)	(3.393)	(7.544)	(12.807)	(6.756)	(11.116)
Female	1.391	0.914	0.477	−22.120***	−5.874	−16.246**
	(8.460)	(1.808)	(7.945)	(7.750)	(3.801)	(6.769)
Retired	−9.067	−8.214***	−0.853	3.588	−0.717	4.305
	(20.126)	(3.029)	(19.171)	(14.153)	(4.940)	(13.263)
College education	98.141***	36.322***	61.819***	77.719***	26.449***	51.270***
	(10.382)	(1.904)	(9.830)	(8.100)	(3.404)	(7.531)
Age	9.636***	1.217***	8.420***	5.212***	−1.031	6.243***
	(0.875)	(0.303)	(0.812)	(1.985)	(0.694)	(1.909)
Age squared	−0.063***	−0.020***	−0.043***	−0.028	−0.004	−0.024
	(0.011)	(0.003)	(0.011)	(0.020)	(0.006)	(0.020)
ihs(household income)	13.345**	2.885*	10.460**	16.162**	6.761***	9.401*
	(5.227)	(1.533)	(4.644)	(7.159)	(2.482)	(5.101)
DHS sample	−38.178***	−12.103***	−26.076***			
	(6.197)	(2.007)	(5.708)			
Adjusted R^2	0.019	0.132	0.015	0.152	0.207	0.158
Mean dependent variable	193.859	73.842	120.016	169.872	65.008	104.865
Fraction non-zero	0.991	0.689	0.995	0.993	0.671	0.995

All columns are estimated with OLS, and standard errors are clustered at the level of the individual. Year fixed effects are included, but not reported. Dependent variables are divided by a 1,000. Income is transformed using the inverse hyperbolic sine transformation in order to incorporate negative and zero values. The baseline for urbanization is "Very high urbanization". The pooled sample has 24,534 observations for 18,698 unique households. The DHS sample contains 7,969 observations for 2,134 households.
*/**/*** correspond to 10%/5%/1%.

Table 14: Inflation Expectations and Ownership of Assets, Administrative Data

	Pooled DHS and CCO				DHS			
	Savings	Bonds	Stocks	House	Savings	Bonds	Stocks	House
Inflation expectations	0.0002	−0.0007***	−0.0031***	−0.0041***	−0.0010	−0.0047**	−0.0285***	−0.0187***
	(0.0001)	(0.0002)	(0.0005)	(0.0006)	(0.0011)	(0.0020)	(0.0048)	(0.0053)
Regional unemployment	0.0004	−0.0014	0.0008	0.0019	0.0023	−0.0082	−0.0113	0.0191
	(0.0011)	(0.0027)	(0.0061)	(0.0055)	(0.0030)	(0.0080)	(0.0179)	(0.0161)
Couple	0.0100***	0.0018	0.0318***	0.1986***	0.0118**	−0.0162	−0.0182	0.1873***
	(0.0021)	(0.0054)	(0.0111)	(0.0111)	(0.0049)	(0.0165)	(0.0319)	(0.0302)
Number of household members	0.0020***	0.0014	0.0113**	0.0175***	−0.0032	0.0101	0.0152	0.0242*
	(0.0007)	(0.0023)	(0.0045)	(0.0034)	(0.0028)	(0.0112)	(0.0179)	(0.0127)
Children in the house	0.0025	−0.0038	−0.0107	0.0429***	0.0047	−0.0136	−0.0836**	0.0016
	(0.0021)	(0.0056)	(0.0134)	(0.0112)	(0.0064)	(0.0218)	(0.0393)	(0.0332)
High urbanization	0.0056*	0.0141***	−0.0018	0.0983***	0.0107*	0.0216*	0.0492	0.1361***
	(0.0030)	(0.0053)	(0.0141)	(0.0149)	(0.0060)	(0.0127)	(0.0333)	(0.0358)
Moderate urbanization	0.0069**	0.0224***	0.0195	0.1754***	0.0069	0.0218*	0.0590*	0.2383***
	(0.0031)	(0.0056)	(0.0147)	(0.0150)	(0.0068)	(0.0131)	(0.0350)	(0.0357)
Low urbanization	0.0074***	0.0316***	0.0117	0.1901***	0.0121**	0.0474***	0.0781**	0.2451***
	(0.0028)	(0.0059)	(0.0145)	(0.0147)	(0.0059)	(0.0149)	(0.0358)	(0.0363)
Very low urbanization	0.0051	0.0364***	0.0210	0.2007***	0.0081	0.0498***	0.0579	0.2306***
	(0.0032)	(0.0076)	(0.0166)	(0.0159)	(0.0064)	(0.0182)	(0.0382)	(0.0371)
Female	0.0046***	0.0039	−0.0295***	−0.0281***	0.0016	−0.0038	−0.1018***	−0.0740***
	(0.0016)	(0.0037)	(0.0080)	(0.0078)	(0.0040)	(0.0111)	(0.0248)	(0.0252)
Retired	−0.0008	0.0153*	−0.0145	−0.0016	0.0009	0.0095	−0.0372	0.0087
	(0.0025)	(0.0092)	(0.0173)	(0.0158)	(0.0047)	(0.0194)	(0.0363)	(0.0331)
College education	0.0078***	0.0335***	0.1671***	0.1305***	0.0091***	0.0431***	0.1609***	0.1430***
	(0.0014)	(0.0043)	(0.0088)	(0.0078)	(0.0030)	(0.0108)	(0.0221)	(0.0197)
Age/10	−0.0000	0.0033	0.1097***	0.1783***	−0.0050	−0.0120	0.1588***	0.0962**
	(0.0044)	(0.0089)	(0.0179)	(0.0187)	(0.0097)	(0.0244)	(0.0496)	(0.0486)
Age/10 squared	0.0001	0.0005	−0.0088***	−0.0175***	0.0003	0.0025	−0.0126***	−0.0098**
	(0.0004)	(0.0010)	(0.0018)	(0.0018)	(0.0008)	(0.0026)	(0.0048)	(0.0046)
ihs(household income)	0.0020***	0.0064***	0.0162***	0.0198***	0.0029	0.0085***	0.0398***	0.0355**
	(0.0007)	(0.0010)	(0.0034)	(0.0035)	(0.0018)	(0.0027)	(0.0109)	(0.0141)
ihs(net worth)	0.0014***	0.0023***	0.0075***	0.0038***	0.0020***	0.0028***	0.0083***	0.0033***
	(0.0001)	(0.0001)	(0.0005)	(0.0004)	(0.0003)	(0.0004)	(0.0013)	(0.0010)
DHS sample	0.0036*	0.0122**	0.0571***	−0.0231**				
	(0.0019)	(0.0057)	(0.0117)	(0.0110)				
Adjusted R^2	0.024	0.037	0.085	0.184	0.028	0.048	0.097	0.201
Mean dependent variable	0.990	0.047	0.282	0.751	0.988	0.059	0.349	0.739
Without Net Worth								
Inflation expectations	0.0001	−0.0008***	−0.0035***	−0.0045***	−0.0011	−0.0049**	−0.0289***	−0.0200***
	(0.0001)	(0.0002)	(0.0005)	(0.0006)	(0.0011)	(0.0020)	(0.0049)	(0.0051)

All columns are estimated with linear probability models (OLS), and standard errors are clustered at the level of the individual. Year fixed effects are included, but not reported. The pooled sample has 24,534 observations for 18,698 unique households. The DHS sample contains 7,969 observations for 2,134 households.

*/**/*** correspond to 10%/5%/1%.

Table 15: Inflation Expectations and Asset Values, Administrative Data

	Pooled DHS and CCO					DHS				
	Savings	Bonds	Stocks	Financial	Housing	Savings	Bonds	Stocks	Financial	Housing
Inflation expectations	−366.2***	−31.6**	−144.3***	−542.1***	−1059.5***	−1042.6***	55.1	−829.8**	−1816.8***	−3751.7***
	(62.3)	(14.8)	(47.0)	(95.7)	(106.7)	(371.3)	(153.6)	(388.7)	(690.7)	(1099.3)
Regional unemployment	713.4	27.7	149.7	890.8	−6120.4***	834.6	−239.1	757.9	1353.8	−4118.9
	(1231.4)	(359.5)	(848.8)	(1916.2)	(1209.3)	(3197.9)	(695.0)	(2022.8)	(4785.8)	(3523.7)
Couple	7626.4***	127.4	4291.1***	12044.6***	36258.2***	3261.5	−642.4	1148.7	3768.9	32255.5***
	(1465.8)	(512.4)	(1622.4)	(2775.5)	(2240.3)	(2740.9)	(1171.5)	(2728.9)	(5259.9)	(5941.3)
Number of household members	661.3	134.7	481.1	1276.6	9707.3***	528.2	−304.4	−703.6	−484.7	7448.2**
	(724.2)	(360.2)	(630.6)	(1318.9)	(904.8)	(1475.2)	(449.4)	(1290.8)	(2513.2)	(3056.0)
Children in the house	−877.2	−532.4	−863.1	−2272.0	−1021.6	−3917.4	1184.7	1219.6	−1502.3	−3704.6
	(1592.9)	(833.9)	(1415.7)	(2893.5)	(2448.7)	(3547.8)	(1172.3)	(3137.3)	(6019.1)	(6704.7)
High urbanization	−2695.1	1585.9**	48.8	−1060.5	2984.4	−677.8	2116.9*	5356.2*	6795.4	12209.7*
	(1671.8)	(722.7)	(1954.8)	(3240.8)	(2943.5)	(2687.6)	(1106.4)	(2887.2)	(5236.5)	(6705.4)
Moderate urbanization	1482.0	739.2	−1421.2	799.1	19418.1***	339.0	594.3	1567.2	2497.6	31498.5***
	(2165.0)	(565.8)	(1835.8)	(3385.7)	(3092.0)	(2919.6)	(412.5)	(2247.6)	(4490.0)	(6997.0)
Low urbanization	1269.3	1080.0*	−2011.6	336.7	21279.6***	5047.2	2223.5**	5522.3*	12790.8	40766.9***
	(2500.7)	(600.3)	(1953.3)	(4000.4)	(3209.7)	(5536.5)	(1131.9)	(3255.4)	(8145.4)	(7971.8)
Very low urbanization	591.6	933.3	−3090.6*	−1567.2	18662.5***	2888.4	1245.0**	391.2	4521.3	41622.4***
	(2074.7)	(666.4)	(1798.3)	(3345.9)	(3421.8)	(3478.3)	(506.6)	(2052.0)	(4744.0)	(7822.3)
Female	−37.9	415.7	−829.7	−452.3	−2096.3	−4306.5**	336.9	−3268.4*	−7241.0*	−14869.2***
	(1119.1)	(506.3)	(1053.7)	(2101.1)	(1543.1)	(2114.2)	(930.5)	(1780.5)	(3860.0)	(4446.6)
Retired	235.2	1967.1*	1826.3	4029.2	2096.8	−1784.8	804.5	−3545.2	−4523.3	5908.1
	(2703.1)	(1039.0)	(2316.9)	(4838.3)	(3463.2)	(4559.0)	(1913.3)	(3701.0)	(8174.5)	(6944.3)
College education	14403.8***	2598.4***	13498.9***	30500.3***	45346.1***	11467.3***	2051.8**	10862.7***	24379.3***	43624.8***
	(1520.3)	(537.8)	(1351.1)	(2724.3)	(1748.4)	(2577.7)	(832.9)	(2196.3)	(4442.4)	(4271.2)
Age	82.9	62.1	174.2	319.0	3567.4***	−615.9	13.0	−164.8	−768.7	1645.9
	(342.3)	(85.3)	(246.5)	(520.1)	(381.4)	(983.3)	(193.5)	(531.0)	(1397.3)	(1007.9)
Age squared	1.8	−0.5	0.6	2.0	−30.0***	8.3	0.4	5.0	13.8	−10.3
	(3.7)	(0.9)	(2.6)	(5.6)	(3.9)	(10.3)	(2.1)	(5.6)	(14.8)	(10.0)
ihs(household income)	3558.9***	659.3***	−785.0	3433.3	5633.6***	5506.4***	389.1**	2402.8***	8298.4***	10126.9***
	(906.6)	(163.2)	(1653.8)	(2279.4)	(1043.9)	(1583.9)	(190.2)	(801.1)	(2381.8)	(3497.4)
ihs(net worth)	1792.9***	170.9***	753.8***	2717.6***	1967.1***	1458.9***	105.8***	596.9***	2161.9***	1574.6***
	(61.2)	(31.9)	(68.7)	(129.2)	(87.6)	(90.3)	(32.3)	(76.8)	(156.4)	(206.5)
dhs	−5745.7***	−591.8	−2468.3*	−8806.0***	−8975.2***					
	(1571.4)	(574.6)	(1407.2)	(2782.2)	(2255.1)					
Adjusted R^2	0.049	0.005	0.020	0.042	0.205	0.078	0.011	0.051	0.090	0.217
Mean dependent variable	31580	2238	11437	45255	116069	27806	1694	10139	39636	116933
Fraction non-zero	0.990	0.047	0.282	0.991	0.743	0.988	0.059	0.349	0.990	0.736
Without Net Worth										
Inflation expectations	−449.4***	−39.5***	−179.3***	−668.2***	−1150.8***	−1112.1***	50.1	−858.2**	−1919.8***	−3826.8***
	(63.1)	(15.3)	(46.6)	(96.0)	(110.4)	(391.2)	(152.7)	(391.4)	(711.7)	(1108.5)

All columns are estimated with OLS, and standard errors are clustered at the individual level. Year fixed effects are included, but not reported. The pooled sample has 24,534 observations for 18,698 unique households. The DHS sample contains 7,969 observations for 2,134 households. */**/*** correspond to 10%/5%/1%.